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Student Engagement as Predicted by Free Web-Based Science Applications and Technology Self-Efficacy Among Learners in the Junior High School Program

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Abstract — The lack of interest in science among junior high school students continues to raise concern. This study investigates how using free web-based science tools relates to students' self-confidence in science and their enthusiasm for the subject. The study randomly selected 235 ninth- and tenth-grade students and analysed the data using multiple linear regression. The results indicate that both factors significantly influence students' enthusiasm for science, accounting for 67% of the variance. These findings support Social Cognitive Theory, which posits that environmental interactions shape a person's enthusiasm. Future research should incorporate additional variables and adopt qualitative methods to gain deeper insights into the factors influencing students' enthusiasm. This research may inform the development of programs that promote free web-based tools and boost students' confidence, fostering enthusiasm for science.

Keywords: Student Enthusiasm, Free Web-Based Science Tools, Technology Self-Confidence, Junior High School Program

I. INTRODUCTION

The Problem and Its Scope

Student engagement is vital for learning success, yet many junior high school students lose interest as they progress from elementary to secondary levels. Research shows engagement often declines at this stage, impacting academic achievement and making it a continuing priority for educators.

Research from around the world shows that student disengagement in secondary schools is a common problem. Countries like England, Finland, Ireland, and Indonesia experience this issue (Jerrim et al.). 2024; Lotulung et al. 2023; Putri et al. 2023). These findings highlight the urgency of widespread solutions.

In the Philippines, disengagement among junior high school students is a notable concern. Many students demonstrate only moderate engagement, pointing to a need for strategies that encourage meaningful participation (Escarlos et al.). 2025; Gallego et al. 2025).

Disengagement can result in poor academic performance, lower attendance, reduced motivation, and an increased risk of dropping out. Students fail to attain their full academic potential when engagement is lacking (Kahu et al., 2023; Lotulung, 2023). Addressing disengagement in secondary education is therefore essential. This study seeks to identify factors influencing student engagement in the Philippine setting.

Significance of the Study

This study advances UNESCO's fourth Sustainable Development Goal, aiming to provide quality education universally, inclusively, and equitably, as well as lifelong learning for all. By investigating how free web-based science applications and self-efficacy in using technology impact student engagement, this study supports educational institutions in implementing effective technology-based teaching methodologies as directed by the Department of Education. The results align with the institution's mission and vision and offer evidence-based strategies to support student achievement through digital literacy and holistic development. Furthermore, these findings provide a practical model for educators and curriculum designers to create innovative ways that motivate and engage students using free web-based applications.

Statement of the Problem

This study examines whether the use of free web-based science applications and technological self-efficacy predict junior high school students' engagement in science. Specifically, the study seeks to:

1. describe the level of students' use of free web-based science applications in terms of perceived usefulness, ease of use, enjoyment, and application self-efficacy; the level of students' technological self-efficacy in basic use and application for learning; and the level of student engagement in behavioral, cognitive, and emotional dimensions;

2. determine the significance of the relationships among students' use of free web-based science applications, their technological self-efficacy, and student engagement; and

3. assess the predictive significance of a model for student engagement using free web-based science applications and self-efficacy as predictors.

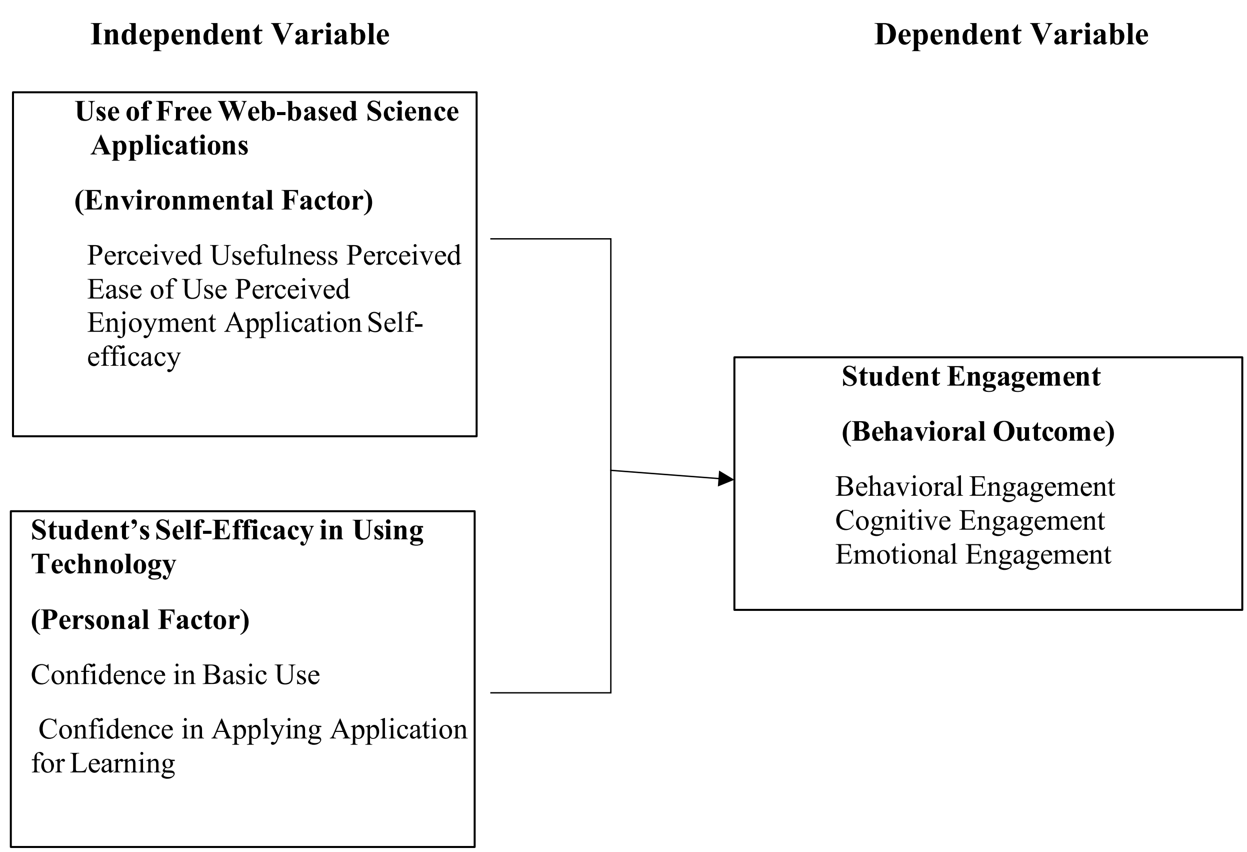
Hypotheses:

Ho1: There is no significant correlation between students' use of free web-based science applications and their level of self-efficacy in using technology, as well as their level of engagement in science subject matter.

Ho2: The model for predicting students' level of engagement using free web-based science applications and self-efficacy is not predictive.

Theoretical and Conceptual Framework

This study is grounded in Bandura's (1985) Social Cognitive Theory (SCT), which proposes that learning occurs within a social context through the dynamic interaction of three factors: personal, environmental, and behavioural. Personal factors refer to an individual's beliefs about their own capabilities, while environmental factors encompass external influences that can affect behaviour. In this context, behaviour refers to an individual's actions. The interaction among these three factors illustrates that individuals are neither passive recipients of their environment nor entirely independent of it. Instead, individuals act as active agents who both influence and are influenced by their surroundings. In this study, the use of free web-based science applications serves as the environmental factor, reflecting learners' confidence in effectively using technology. The behavioural outcome associated with this environmental factor is student engagement. Therefore, this study is firmly grounded in the core principles of SCT.



II. METHODOLOGY

This chapter outlines the methodology, including research design, study locale, sampling, data gathering, analysis, and ethics.

Research Design

This section elaborates on the research design, study locale, sample, sampling techniques, data collection, analysis, and ethical considerations described in this chapter.

Locale of the Study

The study took place in three private junior high schools in Davao City known for using free web-based science applications and having adequate technological facilities.

Sample and Sampling Technique

The study involved 9th- and 10th-grade science students from three private schools in Davao City. Slovin's formula yielded a target sample of 235 students from a pool of about 600. Proportionate stratified random sampling ensured representation by grade and section, supporting reliability and generalisability (Babbie 2020; Creswell et al. 2023).

Eligibility criteria included internet access, good attendance (less than 20% absences), enrollment in traditional programs, and parental consent. These ensured genuine digital use and representative sampling.

Data Gathering Technique

The main tool was a survey assessing students' use and perceptions of free web-based science applications, including usability, enjoyment, and self-efficacy (Babbie 2020; Creswell et al. 2023). The Computer Self-Efficacy Questionnaire (Cassidy et al. 2002) measured students' confidence in using technology, and the Students' Engagement Questionnaire (Maroco et al. 2016) assessed behavioural, cognitive, and emotional engagement.

The consolidated instrument consisted of 39 items: 15 measured the independent variables, specifically, use of free web-based science applications (defined in this study as the frequency and manner in which students engage with web-based tools for science learning), and self-efficacy (defined as an individual’s belief in their capacity to use technological applications effectively). Another 15 items measured the dependent variables, defined as student engagement (encompassing behavioural, cognitive, and emotional engagement in science learning activities). Clarity and reliability were reviewed by three experts, with Cronbach's alpha ≥.93 indicating high reliability. Descriptive statistics summarised and organised the dataset. The analysis included measures of central tendency, such as the mean, and measures of variability, including the standard deviation. JASP (2025) was employed to conduct the analysis. This technique was applied at the initial stage of analysis to ensure data integrity and to identify any potential outliers. Additionally, it helped to develop a clear profile of the variables under investigation. One significant advantage of descriptive statistics is its ability to simplify complex datasets into numerical summaries that are easily interpretable for decision-makers and allow researchers to confirm whether the assumptions required for subsequent inferential analyses have been satisfied (Alabi and Bukola, 2023).

Correlation analysis examined relationships among variables (Dudas et al. 2025; Janse et al. 2021). Multiple linear regression (MLR) determined predictor contribution, using t-coefficients (Montgomery et al. 2024; Refat et al. 2024).

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The study interpreted the mean scores as follows:

Range of means	Descriptive Level	Free Web-Based Science Application	Self-efficacy	Student Engagement
3.26-4.00	Very high	Very good	Very good	Very good
2.50-3.25	High	Good	Good	Good
1.75-2.49	Low	Poor	Poor	Poor
1.00-1.74	Very low	Very poor	Very poor	Very poor

The standard deviation (SD) represents the data's dispersion as follows:

Range	Description	Interpretation
SD≤0.50	Highly Consistent Responses	Strong and uniform perception
SD = 0.51 – 1.00	Moderately Consistent	Responses Acceptable Consistency
SD = 1.01 – 1.50	Low Consistency Responses:	Differing views or experiences
SD > 1.50 Very	Low Consistency Responses:	High variability and lack of consensus

This study set the significance level for correlation at 0.05 and interpreted Pearson's r according to Guilford's (1956) conventions.

Computed r	Descriptive Interpretation
+/- 1.00	Perfect correlation
Between +/- 0.75 – +/- 0.99	High correlation
Between +/- 0.51 – +/- 0.74	Moderately high correlation
Between +/- 0.31 – +/- 0.50	Moderately low correlation
Between +/- 0.01 – +/- 0.30	Low correlation
0.00	No correlation

The interpretation of beta (β) coefficients followed established conventions based on Cohen (1988) and Hair et al. (2019).

β Value Range	Strength of the Influence
±0.00 – ±0.09	Very Weak
±0.10 – ±0.29	Weak
±0.30 – ±0.49	Moderate
±0.50 – ±0.69	Strong
±0.70 and above	Very Strong

Ethical Consideration

Following Cohen (1988) and Hair et al. (2019), this study evaluated the magnitude of the beta-coefficients. The research process and instruments met high academic and ethical standards (APA 2020; Creswell and Creswell 2018). The study addressed minimal risks and took steps to reduce participants' discomfort.

Participants and guardians gave informed consent. Confidentiality and anonymity were maintained using coded responses and secure data storage. This study utilised data strictly for academic purposes. The Institutional Review Board approved the study to protect participants' rights. The appropriate authorities approved the study to protect participants' rights.

III. RESULTS

This chapter presents the results of the study, including the descriptive statistics, correlation analysis, and summary of findings.

Descriptive Results

Table 1 presents the descriptive statistics for the variables examined in this study, including the utilisation of free web-based science applications, technological self-efficacy, and student engagement. It also presents the mean, standard deviation, and descriptive level for each variable and its indicators. It also presents the mean, standard deviation, and descriptive level for each variable and its indicators.

TABLE 1
DESCRIPTIVE STATISTICS (N = 235)

Variables	Standard Deviation	Mean	Descriptive Level
Free Web-based Science Application	**0.36**	**3.12**	**High**
Perceived Usefulness	0.49	3.21	High
Perceived Ease of Use	0.43	3.06	High
Perceived Enjoyment	0.45	3.08	High
Application Self-efficacy	0.45	3.15	High
Self-efficacy in using Technology	**0.42**	**3.09**	**High**
Confidence in Basic Use	0.50	2.99	High
Applying Applications for Productivity and Learning	0.44	3.18	High
Student Engagement	**0.41**	**3.15**	**High**
Behavioral	0.42	3.17	High
Cognitive	0.53	3.09	High
Emotional	0.45	3.18	High

Table 1 shows that the overall mean score for free web-based science applications is 3.12, which is high, indicating that respondents use them at a good level. All indicators also obtained high mean scores. The standard deviation of 0.36 indicated highly consistent responses, suggesting a strong and uniform perception among respondents.

Similarly, the mean score for technological self-efficacy was 3.09 out of 5, indicating that respondents demonstrate a high level of technological self-efficacy. All its indicators likewise yielded high mean scores. The standard deviation of 0.42 reflects highly consistent responses.

Furthermore, student engagement had a mean score of 3.15, indicating a high level of engagement. All indicators, behavioural, cognitive, and emotional, recorded high mean scores. The standard deviation of 0.41 indicates highly consistent responses.

Overall, the results reveal that free web-based science applications, technological self-efficacy, and student engagement are all at high levels. Among these variables, student engagement appears slightly higher, while the other two variables show comparably strong and consistent perceptions among respondents.

Correlation Results

Table 2 presents the correlation analysis between the independent variables and student engagement. It includes the r-values, p-values, decision on the null hypothesis, and corresponding interpretations.

TABLE 2
CORRELATION TABLE (N=235)

Variables	Student Engagement			
	r-value	p-value	Decision on *H*0	Interpretation
Free Web-based Science Applications	0.75	.001	Reject *H*0	Significant
Self-efficacy in using Technology	0.76	.001	Reject *H*0	Significant

Level of Significance: 0.05
Decision Rule: Reject H_0 if $p < 0.05$

The results show that free web-based science applications have a significant positive relationship with student engagement ($r = 0.75$, $p = 0.001$). Since the p-value is less than 0.05, the null hypothesis is rejected. The r-value indicates a high positive correlation, suggesting that higher use of web-based applications is associated with higher student engagement.

Moreover, a strong correlation was found between technological self-efficacy and student engagement ($r = 0.76$, $p = 0.001$), indicating that students who are confident in their technological abilities are more engaged in their studies. Accordingly, the findings reject the null hypothesis. The R-value indicates a strong positive correlation, suggesting that higher self-efficacy is associated with greater student engagement.

Overall, both variables demonstrate strong and significant positive relationships with student engagement. Notably, technological self-efficacy shows a slightly stronger correlation compared to free web-based science applications.

Regression Results

Table 3 presents the results of the multiple linear regression analysis, including the unstandardised coefficients, t-values, p-values, and decisions on the null hypothesis.

TABLE 3
REGRESSION TABLE (N=235)

	Student Engagement						
	Unstandardised Coefficients		**Standardised Coefficients**				
Independent Variables	**B**	**Std. Error**	**Beta**	**t**	**Sig.**	**Decision on H_0**	**Interpretation**
(Constant)	.35	.14	-	2.59	.010	-	-
Free Web-based Science Applications	.46	.07	.42	7.14	.000	Reject	Significant
Self-efficacy in using Technology	.43	.06	.45	7.67	.000	Reject	Significant

$R = 0.81 | R^2 = 0.67 | F = 223.14 | p = 0.000$

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

Predictive model: SE = 0.46 FWSA + 0.43 ST + 0.35

The results indicate that the regression model predicting student engagement from free web-based science applications and technological self-efficacy is statistically significant ($p < 0.05$). Therefore, the study rejects the null hypothesis. The predictive model takes the following form: SE = 0.46(FWSA) + 0.43(ST) + 0.35.

This study found that, controlling for technological self-efficacy, a one-unit increase in the use of free web-based science applications increases overall student engagement by 0.46 points. Compared with a one-unit increase in technological self-efficacy, a one-unit increase in student engagement is associated with a 0.43 increase.

The coefficient of determination (R2 = 0.67) indicates that the combined influence of free web-based science applications and technological self-efficacy explains 67% of the variance in student engagement.

Both predictors are statistically significant, with technological self-efficacy (β=0.45) showing a slightly stronger influence than free web-based science applications (β=0.42).

Summary of Findings

Based on the statistical analyses, the study found that:

1. Free web-based science applications and technological self-efficacy both have significant positive relationships with student engagement.

2. The regression model using free web-based science applications and technological self-efficacy significantly predicts student engagement.

IV. DISCUSSIONS

This section discusses the study's findings and presents the conclusions and recommendations.

Free Web-Based Science Applications, Technology Self-Efficacy, and Student Engagement Correlation

The study found that technological self-efficacy has a significant positive relationship with student engagement. This finding supports the study of Getenet et al. (2024), which demonstrated that students' digital technology self-efficacy significantly influences various dimensions of online learning engagement. The findings indicate that students with greater confidence in using digital technologies are more likely to engage actively in learning activities. Similarly, this finding is consistent with Wu (2023), who reported that higher self-efficacy is associated with greater student engagement in online learning environments.

However, this finding contrasts with that of Sui et al. (2023), who argued that self-efficacy does not directly influence learning engagement but rather does so indirectly through mediating variables such as perceived technology use and learning strategies. This divergence implies that while self-efficacy is significantly related to student engagement in the present study, its role may be more complex and potentially mediated by other factors. It is also important to note that the Philippine educational context frames this study, which may account for variations in the results.

Student Engagement as Predicted by Free Web-Based Science Applications and Technology Self-Efficacy

The findings further revealed that free web-based science applications and technological self-efficacy significantly predict student engagement. The findings indicate that both environmental and personal factors strongly influence students' engagement in science learning.

This result supports the finding of Getenet et al. (2024), who reported that digital technology attitudes, literacy, and self-efficacy significantly predict online learning engagement. Likewise, it affirms the study of Kumaz et al. (2024), which found that students' academic self-perceptions significantly predict variations in student engagement. These studies collectively reinforce the importance of internal beliefs and external learning tools in enhancing engagement.

Conversely, this finding contradicts Wang and Zhang (2024), who found that academic self-efficacy did not directly predict student engagement, as psychological resilience and professional commitment fully mediated its effect. This discrepancy suggests that the predictive role of self-efficacy may vary across contexts and intervening variables. Contextual factors may also explain the difference in findings, as Wang and Zhang (2024) sampled students in Henan Province, China. In contrast, the present study focuses on junior high school students in the Philippines.

V. CONCLUSION

Based on the findings, free web-based science applications and technological self-efficacy were significant and strong predictors of student engagement in science among junior high school students, accounting for 67% of the variance. These results suggest that both environmental factors (use of web-based applications) and personal factors (self-efficacy) are substantial determinants of student engagement.

Furthermore, the findings support Social Cognitive Theory, which posits that learning occurs through dynamic, reciprocal interactions among personal factors, environmental influences, and behaviour. The results of the study support the concept of triadic reciprocal determinism, demonstrating that students are active agents whose internal beliefs and external learning environments influence their engagement.

VI. RECOMMENDATIONS

Based on the conclusions, this study proposes the following recommendations:

1. Future studies should incorporate additional variables not included in the present study to account for the remaining 33% of unexplained variance in student engagement.

2. Qualitative research approaches may be employed to explore deeper insights and identify other potential factors influencing student engagement.

3. School administrators and educators should implement programs and training initiatives aimed at enhancing students' use of free web-based science applications and strengthening their technological self-efficacy to improve overall student engagement.

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